

## A. Cover Sheet

1. Specify: ☒ agricultural project or ☒ individual application or  
☒ urban project ☐ joint application
2. Proposal title: **Landscape and Agricultural Area Measurement and Water Use Budgets**
3. Principal applicant -- organization or affiliation: **Santa Clara Valley Water District**
4. Contact - name, title: **Hossein Ashktorab, Water Use Efficiency Unit Manager**
5. Mailing address: **Santa Clara Valley Water District, 5750 Almaden Expressway, San Jose, CA 95118**
6. Telephone: **(408) 265-2607 x2291**
7. Fax: **(408) 978-0156**
8. E-mail: **hashktorab@scvwd.dst.ca.us**
9. Funds requested -- dollar amount: **\$406,000**
10. Applicant cost share funds pledged -- dollar amount: **\$229,712**
11. Duration -- (month/year to month/year): **July 2001 to December 2002**
12. State Assembly and Senate districts and Congressional district(s) where the project is to be conducted:  
State Assembly Districts: **20, 21, 22, 23, 24, 27, and 28**  
State Senatorial Districts: **10, 11, 13, and 15**  
US Congressional Districts: **14, 15, 16, 17**
13. Location and geographic boundaries of the project: **Santa Clara County**
14. Name and signature of official representing applicant. By signing below, the applicant declares the following:  
☐ the truthfulness of all representations in the proposal;  
☐ the individual signing the form is authorized to submit the application on behalf of the applicant;  
☐ the applicant will comply with contract terms and conditions identified in Section 11 of this PSP.

\_\_\_\_\_  
(printed name of applicant)

\_\_\_\_\_  
(date)

\_\_\_\_\_  
(signature of applicant)

## **B. Scope of Work**

### ***B.1 Executive Summary***

This project will acquire multi-spectral images of Santa Clara County, perform image analysis (classification) to identify the areas of turfgrass, other landscaping, water features, bare ground and hardscape for each parcel (site) and prepare a database of these areas to support Landscape Water Budgets for sites with dedicated irrigation meters as well as the ITAP Landscape Survey and Agricultural Mobil Lab Programs. The project will develop classified area data for approximately 23,000 sites and site-specific landscape water use budgets for about 5,500 sites. The project will also develop classified area data for approximately 200 square miles of agricultural lands within the District's service area. Santa Clara Valley Water District (SCVWD) will provide initial Landscape Water Budgets to its retail water suppliers implementing Best Management Practice (BMP) 5, under the Memorandum of Understanding Regarding Urban Water Conservation in California (MOU). SCVWD will routinely update each budget using real-time reference evapotranspiration (ET<sub>o</sub>) data from the California Irrigation Management Information System (CIMIS) so that the budgets reflect actual site irrigation demands during the most recent billing cycle. Concurrently, SCVWD will develop a database-backed website (webITAP) to deliver real-time Landscape Water Budget information to property and landscape managers via the web. It is projected that these Landscape Water Budgets will reduce water use for these sites by at least 10%. In FY1999 annual water use by accounts with dedicated meters was approximately 50,000 af/yr countywide. Annual water savings of approximately 5,000 AF from these accounts are projected for this project.

### ***B.2 Statement of Need***

By 2020, Santa Clara County could experience a water supply shortage of 100,000 acre feet (af) during critical dry years, based on current supplies and projected growth.<sup>1</sup> According to forecasts made by the California Department of Water Resources (DWR), the county is expected to face the largest drought year shortages in the San Francisco Bay Region.<sup>2</sup> In 1994, SCVWD identified water supply reliability as its top priority issue.<sup>3</sup>

The SCVWD Board adopted in 1996 an Integrated Water Resource Plan (IWRP) designed to develop flexible long-term water supply plans that meet the future water needs in the county. SCVWD is currently in the process of updating this plan. The IWRP identifies several core elements intended to close the gap between projected demands and existing sources of supply. One of these core elements is water conservation. SCVWD has set a demand reduction target of 57,100 af/year by 2020. Specific demand reduction targets were developed for five water use sectors: residential interior, residential exterior, commercial/industrial interior, commercial/industrial exterior, and agricultural. These targets are shown in Table 1.

The proposed Landscape and Agricultural Area Measurement and Water Use Budget project is designed to substantially contribute to meeting the commercial/industrial exterior and agricultural targets shown in Table 1. Projected water savings from this project will achieve nearly 70% of targeted commercial/industrial exterior savings for 2010.

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<sup>1</sup> Santa Clara Valley Water District, "Integrated Water Resources Plan: Implementation Plan," June 1999.

<sup>2</sup> California Department of Water Resources, "The California Water Plan Update," Vol. 2, Bulletin 160-98. 1998.

<sup>3</sup> Santa Clara Valley Water District, "Integrated Water Resources Plan: Implementation Plan," June 1999.

**Table 1. Water Use Reductions Anticipated by 2020 by Sector in af/year**

<b>Sector</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>
Residential Interior	12,900	19,200	22,500	22,300	22,300
Residential Exterior	5,800	9,700	12,000	13,400	19,900
Commercial/Indust. Interior	2,100	2,500	2,700	2,700	7,500
<b>Commercial/Indust. Exterior</b>	<b>4,700</b>	<b>7,300</b>	<b>7,500</b>	<b>6,700</b>	<b>6,400</b>
<b>Agricultural</b>	<b>700</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>
Total (af/year)	26,200	39,700	45,700	46,100	57,100

The IWRP also addresses water quality and watershed protection concerns in the region. In this regard, SCVWD has worked with regional environmental organizations and public interest groups to develop the Santa Clara Basin Regional Watershed Management Initiative (WMI). A specific goal of the WMI is to reduce pollution of watershed creeks from urban runoff, including reductions in pesticides, herbicides, and other toxic substances associated with drainage for urban and agricultural irrigation.<sup>4</sup> It is well documented that the overuse of water to maintain urban landscapes results in direct and indirect types of nonpoint-source pollution (NPS). Direct NPS pollution problems associated with water overuse for landscape maintenance include increased nutrient and soil runoff from the landscaped area, as well as other pollutants from urban and developed lands. Indirect NPS pollution problems include increasing overall demand for additional development and use of water supply reservoirs.<sup>5</sup>

Numerous studies demonstrate the leaching potential of nitrogen from turf. Researchers at Cornell University found that 60% of nitrogen applied to turf leached to ground water.<sup>6</sup> Shultz (1989) suggests that 50% of the nitrogen applications are leached out and not used by plants.<sup>7</sup> A study completed by Exner and others (1991) showed that as much as 95% of nitrate applied in late August on an urban lawn was leached below the turf grass root zone.<sup>8</sup>

NPS pollution from excessive landscape and agricultural irrigation in Santa Clara County either leaches into regional groundwater basins or discharges into the San Francisco Bay. By decreasing the amount of water used for landscape maintenance and agricultural production, the proposed Landscape and Agricultural Area Measurement and Water Use Budget project will reduce the entry of these pollutants into regional surface and ground waters. More efficient irrigation practices also reduce the likelihood of pesticide contamination of local ground and surface water supplies.

This project will also demonstrate an efficient technology for obtaining accurate measurements of urban landscaped areas on a large scale. The benefit of this demonstration extends to any large retail or regional wholesale water supplier implementing BMP 5 as well as to State and federal agencies responsible for water resource planning in California. For example, in recent years many urban water suppliers have balked at implementing the water budget requirements of BMP 5 because of concerns

<sup>4</sup> Santa Clara Valley Water District, "Clean, Safe Creeks & Natural Flood Protection," July 2000.

<sup>5</sup> Environmental Protection Agency, "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters," EPA-840-B-93-001c January 1993.

<sup>6</sup> Long Island Regional Planning Board. 1984. Nonpoint Source Management Handbook. Hauppauge, New York.

<sup>7</sup> Schultz, W. 1989. The Chemical-Free Lawn. Rodale Press, Emmaus, PA.

<sup>8</sup> Exner, M.E., M.E. Burbach, D.G. Watts, R.C. Shearman, and R.F. Spalding. 1991. Deep Nitrate Movement in the Unsaturated Zone of a Simulated Urban Lawn. Journal of Environmental Quality, 20:658-662.

about cost and feasibility. A successful conclusion to this project will contribute to broader acceptance and fuller implementation of BMP 5. As another example, DWR has been unable to produce reliable estimates of urban landscaped area and water consumption for use in demand forecasts used by its Bulletin 160 planning process. Consequently, Bulletin 160-98 failed to include the savings potential of BMP 5 in particular and landscape water conservation programs in general in its statewide and regional demand forecasts “due to insufficient base year data on landscape water use and acreage.”<sup>9</sup> The technology proposed for this project may afford DWR a cost-effective way to accurately measure the extent of and water used by urban landscape.

### ***B.3 Project Scope and Objectives***

The primary objective of this project is countywide implementation of BMP 5’s Landscape Water Budget requirement. BMP 5 requires agencies to provide Landscape Water Budgets for at least 90% of their accounts with dedicated landscape meters.<sup>10</sup> The budgets developed through this project are expected to reduce average landscape water use for these sites by at least 10%, or 5,000 af/yr. This estimate is based on the results of a statistical study of four California water agencies providing water budgets to accounts with dedicated landscape meters.<sup>11</sup>

Sites with budgets will receive information on actual landscape water use relative to their budget each billing cycle. This information will initially be provided by the District’s retail water suppliers either as a billing insert or under separate cover depending on the retailer’s billing system capabilities. Upon completion of the webITAP application, site budgets will be migrated to webITAP and accessible via the web. SCVWD staff will monitor performance by individual sites and offer landscape surveys and management assistance to sites having difficulty keeping within their budgets. The District’s ITAP program budget assumes that up to 12% of sites with budgets will require assistance each year.

Landscape area measurements will provide several other water use efficiency and resource planning benefits to the region. For example, area measurements will be used to both target surveys to the region’s largest landscape areas as well as to evaluate landscape characteristics and water use at individual sites receiving assistance through the District’s ITAP Landscape Survey Program. Accurate measurement of urban landscape and agricultural lands will significantly improve the District’s demand forecasts and dry-year planning efforts. Agricultural area measurement will also support the District’s agricultural water conservation programs as required by the Central Valley Project Improvement Act (CVPIA). Hardscape area measurements will be useful to the WMI.

### ***B. 4 Project Methods and Procedures***

Developing a water budget for a site requires two basic inputs: landscape area and weather data. Historical and current weather data are available from CIMIS. This project will provide the second necessary ingredient: landscape area. Area measurements will be generated by acquiring multi-spectral images of Santa Clara County, performing image analysis (classification) to identify the areas of turfgrass, other landscaping, water features, bare ground and hardscape for each parcel (site) and preparing a database of these areas to support Landscape Water Budgets for sites with dedicated

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<sup>9</sup> California Department of Water Resources, “The California Water Plan Update,” Vol. 1, Bulletin 160-98, page 4B-8. 1998.

<sup>10</sup> California Urban Water Conservation Council, “Memorandum of Understanding Regarding Urban Water Conservation in California,” September 1999.

<sup>11</sup> See A & N Technical Services, “Landscape Water Conservation Programs: Evaluation of Water Budget Based Rate Structures,” prepared for the Metropolitan Water District of Southern California. 1997. The study found that landscape water budgets linked to rates reduced average landscape water use by 20%. We project a more conservative 10% savings because not all retail agencies in the county may choose to link the budgets to water rates.

irrigation meters. Landscape measurement data will be combined with parcel data from a high-resolution parcel map being jointly developed by the SCVWD, the City of San Jose, and the County of Santa Clara.<sup>12</sup> The landscape area and parcel data will be loaded into a landscape budget application developed by AquaMetrics LLC to generate site-specific budgets.

The most challenging and expensive task of landscape budget development is producing estimates of landscape area.<sup>13</sup> There are a variety of ways to measure landscape area, including use of customer provided measurement, measurement of landscape plans, use of tax assessor parcel data, use of aerial photography, and use of multi-spectral digital images. Each approach varies in cost, accuracy, timeliness, and resource requirements. A study funded by USBR compared four of the most common measurement techniques: on-site measurement, use of landscape plans, use of aerial photography, and use of multi-spectral images. The study concluded that using multi-spectral images was the most cost-effective way to produce area measurements with medium to high accuracy on a large scale.<sup>14</sup> The cost per site for projects involving 5,000 or more sites was 70% lower than the next cheapest alternative (aerial photography), and only one-tenth the cost of using landscape plans or on-site measurement.<sup>15</sup> With respect to the use of the multi-spectral imaging technique, the study noted that “with a good quality image and an accurate match between parcel map and image, this approach can estimate the landscape size of every site (including residential) in an entire community.”<sup>16</sup>

Multi-spectral image analysis to measure landscape area and classify vegetation has been successfully employed by Contra Costa Water District and is currently being employed by East Bay Municipal Utilities District. SCVWD is using the technology to measure landscape areas for the City of Mountain View as part of an on-going pilot project.

Like any measurement technique, the method is not perfect. Successful application requires having good quality data. Of greatest importance is access to a high quality parcel polygon database for defining site boundaries and for matching water account information to measured landscape areas.<sup>17</sup> As noted at the beginning of this section, SCVWD is jointly developing a high-quality parcel map which will be available to this project by mid 2002.

### ***B.5 Project Schedule***

Please refer to page 12 of this proposal to review the project schedule.

### ***B.6 Monitoring and Assessment***

The District’s IWRP calls for an enhanced water conservation Monitoring and Evaluation (M&E) Program to more rigorously quantify water savings.<sup>18</sup> The M&E Program will include development of an evaluation strategy for each of the District’s existing and planned conservation measures, and a database to track water conservation activities and calculate water savings. As part of this overall monitoring effort, the proposed Landscape and Agricultural Area Measurement and Water Use Budget

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<sup>12</sup> SCVWD expects to complete the parcel map project by mid 2002. The District also has access to the County’s existing parcel map, though this map is lower resolution and deemed less accurate than the new one that will replace it.

<sup>13</sup> California Urban Water Conservation Council, “BMP 5 Handbook: A Guide to Implementing Large Landscape Conservation Programs,” April 1999.

<sup>14</sup> Contra Costa Water District and AquaMetrics LLC, “Landscape Area Measuring Study: Final Evaluation Report,” USBR Grant #7-FG-20-15420. October 1999.

<sup>15</sup> Ibid. Table ES-2, p. 6.

<sup>16</sup> Ibid. p. 15.

<sup>17</sup> Ibid. page 15.

<sup>18</sup> Santa Clara Valley Water District, “Integrated Water Resources Plan: Implementation Plan,” June 1999, p. 4-9.

project will monitor several program performance indicators. Initially these will focus on the performance of the landscape budget program.

*Completed Budgets.* The program will compile quarterly and annual reports on the number of Landscape Water Use Budgets completed, and compare these totals against BMP 5 requirements. This information will also be reported to the CUWCC bi-annually, per BMP 5 reporting requirements.

*Budgeted versus Actual Use.* The program will compile information on budgeted versus actual use for each budgeted site. SCVWD staff will compile and report quarterly and annual summaries of this data. This information will be available to site managers via webITAP. Aggregate actual versus budgeted use summaries will be reported to the CUWCC bi-annually, per BMP 5 reporting requirements.

*Distribution of Sites by Budget Performance.* Data will be compiled quarterly and annually showing the distribution of sites by budget performance. This will enable comparison of aggregate site performance over time.

*Number of Sites Provided Assistance.* Data will be compiled quarterly and annually showing the number of sites requesting assistance with budgets and the number of sites receiving ITAP assistance from SCVWD.

*Pre and Post Assistance Performance.* Data will be compiled quarterly and annually showing pre and post assistance water use relative to budgeted use by site and in aggregate.

A key element to monitoring the performance of landscape water budgets will be coordinating the collection and transfer of water use data from the region's retail water suppliers to the District. The District is in the process of creating these linkages as part of the development of its water conservation M&E Program.

## **C. Outreach, Community Involvement, and Information Transfer**

*Information Transfer.* This program will direct information about Landscape Water Budgets to (1) landscape and property managers, (2) regional environmental and public interest organizations, and (3) water suppliers and water management agencies.

*Landscape and Property Managers.* The effectiveness of a water budget depends largely on whether information about water use from the budget gets to the right people. Budget information needs to go to those individuals that (1) have a direct financial interest in a site's landscape maintenance cost and (2) have the ability to change how the landscape is managed. This program will provide budget notices to two contacts at each site: (1) the person or organization financially responsible for landscape maintenance and (2) the person or organization physically responsible for landscape maintenance. These notices will indicate water use relative to the budget and also translate these indicators to dollar impacts to the customer's bill. Notices will direct customers having trouble meeting the budget to the District's ITAP landscape survey program. The District will also provide information to property owners/managers on how to structure performance-based landscape maintenance contracts that financially reward contractors keeping water use within a site's budget. The District has worked to establish a close relationship with landscape companies and associations in Santa Clara County. In 1999, the District met with the large landscape companies in Santa Clara County to inform them about its Landscape Water Budget program objectives. Feedback on the proposal from landscapers has been positive. The District also provides landscape and irrigation management training workshops annually,

as described later in this proposal. Additionally, the District will continue to work closely with two landscape companies -- Jensen Landscape and MD Landscape -- to install water submeters and establish Landscape Water Budgets at HOA's managed by these companies.

*Regional Environmental and Public Interest Organizations.* For effective watershed protection and management, a broad public understanding of watershed issues is essential. Many educational organizations and groups in the County currently teach and promote watershed-based programs. Through its Santa Clara Basin Regional Watershed Management Initiative (WMI) the District has developed extensive ties to these organizations. The District has compiled an extensive database of organizations (more than 100) and contact data as part of the WMI.<sup>19</sup> Information on the Landscape Water Budget Program and its contribution towards WMI objectives will be disseminated to key regional stakeholders through these organizations. The District believes educating these groups on the linkages between its Landscape Budget Program and the WMI will be essential for building program support and commitment.

*Water Suppliers and Water Management Agencies.* As discussed in Section B6 of this proposal, the District will be monitoring several program performance indicators throughout the life of the program. Information from these monitoring reports will be available to other interested water suppliers and water management agencies. In addition, the District will make bi-annual reports to the CUWCC on the performance of its Landscape Budget Program. It is anticipated that this information will be publicly available to any interested organization via the CUWCC's website.

*Training and Capacity Building.* Each year the District hosts 1-day and 2-day workshops (water budgeting and auditing) for landscape professionals. Notices of the workshops are distributed to landscape contracting and maintenance firms throughout the county. The workshops address AB 325 compliance, development of efficient irrigation schedules, forecasting water use and cost, developing "what-if" planting scenarios to comply with water budgets, and much more. At least one workshop each year is offered in Spanish. These workshops will be continued throughout the Landscape Water Budget program to educate local landscape installation and maintenance companies about water budgets. Training programs will integrate with the WMI. In this regard, the District is developing a series of training classes and workshops for landscape managers addressing nitrate management through more efficient irrigation practices.

## **D. Qualifications of the Applicants, Cooperators, and Establishment of Partnerships**

*Applicant Qualifications.* Resumes of key District staff participating in this project are attached to the back of this proposal.

*External Cooperators.* During the budget development phase of this project the District will work with outside firms to obtain the multi-spectral images and perform the image processing. The cost of these tasks requires that the District put this work out to bid. It is therefore not possible at this time to say definitively who the District will hire to perform this work. However, as part of the Mountain View Pilot Project, the District solicited qualifications of firms through a formal RFQ process. The District has developed a short list of candidate firms that have demonstrated the necessary knowledge and project experience to perform these tasks. Two of the firms -- Pacific Meridian Resources

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<sup>19</sup> Santa Clara Valley Water District, "Watershed Management Report: Volume 1, Unabridged," Table 5-1. May 2000.

([www.pacificmeridian.com](http://www.pacificmeridian.com)) and The Map Factory - HJW ([www.mapfactory.com](http://www.mapfactory.com)) -- have been successfully used by EBMUD and CCWD, respectively, to develop multi-spectral images of their service areas for the purposes of landscape classification and budget development. The District is currently working with Pacific Meridian Resources to develop the multi-spectral images for the Mountain View Pilot Project. Full qualifications and project examples for each of these candidate firms are available from their above referenced websites.

As noted in Section B4 of this proposal, the District is working with the City of San Jose and the County of Santa Clara to develop a high-resolution parcel map of the county. The multi-spectral image map will overlay the parcel map thus allowing landscape area measurements for each parcel. The three project participants will evenly share the costs, about \$400,000 each, of the parcel map project. The delivery date for the map is mid 2002.

***Retail Agency Partnerships.*** To develop site-specific budgets the District will need to obtain account information and water use histories from its local retail water suppliers. These include the cities of San Jose, Mountain View, Milpitas, Gilroy, and Morgan Hill, and the investor-owned utilities San Jose Water Company and California Water Service Company. The District has already informally approached each of these suppliers and discussed the program, and each supplier has expressed interest in participating. The District has also sent each supplier a letter outlining the program and formally requesting cooperation. A copy of this letter is attached to this proposal. Currently the City of Mountain View is serving as a test site for the District's Landscape Area Measurement Pilot Project, as mentioned earlier in this proposal. As also discussed previously, the City of San Jose is working with the District and the County to develop the parcel map that will be used for this project.

## **E. Costs and Benefits**

***Project Budget Summary.*** Project costs to develop landscape area measurements and water budgets are summarized in Table 2. Estimated total cost for development is \$635,712. District staff labor and overhead costs account for approximately 36% of this total. Outside services and consultants to obtain and analyze the multi-spectral images and develop landscape area maps comprise the remaining 64%. The following is a brief explanation of cost elements presented in Table 2.

***Salary and wages.*** Average hourly rates for salaries and wages for District staff assigned to this project were derived from salary scales posted for the District's Water Use Efficiency and Information Technology units (<http://www.scvwd.dst.ca.us/fyi/classspec1.htm#fna>). Time estimates for loading landscape area measurement data and matching parcel information to billing accounts were developed by AquaMetrics, LLC. Time estimates for development of webITAP are based on estimates prepared by the District's Information Technology unit.

***Fringe benefits & overhead.*** Average hourly rates for benefits were developed from the District's standard benefits package, as posted at <http://www.scvwd.dst.ca.us/fyi/recuitpg1.htm>. Overhead rates are the same as used by the District for annual budget development.

***Services and consultants.*** The cost estimate to obtain and process the multi-spectral images is based on field experience and preliminary results of the Mountain View Pilot Project. This estimate was developed in consultation with AquaMetrics LLC. The cost estimate for resolving image discrepancies



between the parcel map and the multi-spectral landscape map were developed in consultation with AquaMetrics, LLC, and are based on data developed for USBR and CCWD.<sup>20</sup>

### ***Project Benefit Summary***

*Project Outcomes.* The primary outcome of this project will be a countywide reduction in water use for urban landscape and agricultural production. The District expects Landscape Water Budgets developed by this project will reduce landscape water use at sites with dedicated irrigation meters by an average of 10% annually, or about 5,000 af per year. Use of area measurement and crop classification data by the District's Mobile Lab program will produce additional water savings in the agricultural sector, though these savings have not been quantified due to insufficient data on cropping patterns and water use by the District's agricultural customers. As discussed in section B2, this project will also reduce NPS pollution to regional surface and groundwater resources, and ultimately to the San Francisco Bay, caused by over-irrigation of urban landscape and agricultural lands. The reduction in NPS discharge will be proportional to the reduction in water application induced by the budgets.

*Regional Project Benefits.* The monetary benefit to the District and its customers of reduced demand for water can be expressed in terms of avoided water acquisition and treatment costs. This benefit varies by year, depending on both hydrologic conditions and the marginal cost of supply. In normal and wet years the District expects to meet projected demands with a combination of local and imported surface water and groundwater resources. The District's CVP contract is the marginal source of supply during these years. In dry and critically dry years the District anticipates having to secure supplemental supply through water marketing and banking programs. These programs will constitute the District's marginal source of supply during dry and critically dry years. Avoided supply acquisition and treatment costs were evaluated using a weighted average avoided cost of supply for the District developed for the Bay Area Water Recycling Program in the late 1990s. Weights were derived from a District shortage probability forecast developed for the IWRP. The weighted average avoided cost of supply and resulting avoided cost benefit are shown in Table 3, which summarizes the cost-benefit analysis of this project.

This project will also help achieve regional watershed management goals expressed in the WMI. Data limitations prevent the quantification of these benefits at this time. However, stakeholders to the WMI see reducing NPS pollution to regional surface and groundwater resources as integral to the overall WMI. These stakeholders are strongly supportive of the Landscape and Agricultural Area Measurement and Water Use Budget project, and wish to see it funded and implemented. Copies of project endorsement letters from WMI stakeholders are appended to this application for reference.

*CALFED Project Benefits.* This project directly contributes to two CALFED program objectives: (1) reducing the mismatch between Bay-Delta supplies and current and projected beneficial uses dependent on the Bay-Delta; and (2) improving water quality for all beneficial uses. The District's conservation measures benefit the Bay/Delta watershed by reducing the District's overall reliance on water supplies imported from the State and federal projects. The District's conservation efforts are important as part of a long-term, comprehensive effort to reduce pressure on the Bay/Delta system to meet the State's water needs. This is particularly important in light of future growth expected in Santa Clara and other Delta export counties. Currently, water imported from the Bay/Delta is used to meet almost half of the County's water demands. In dry years, local runoff is very limited, and imported supplies may be used to meet up to 90% of the County's water needs.

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<sup>20</sup> Contra Costa Water District and AquaMetrics LLC, "Landscape Area Measuring Study: Final Evaluation Report," USBR Grant #7-FG-20-15420. October 1999.

Another CALFED objective is to continuously improve source water quality that allows for municipal water suppliers to deliver safe, reliable, and affordable drinking water that meets and, where feasible, is better than applicable drinking water standards. While efforts to meet this objective will primarily focus on protection and improvement of Bay/Delta watersheds and source waters, they may also address local watersheds and supply sources to the extent that these local resources are blended with or supplemented for Bay/Delta sources providing drinking water. By reducing NPS pollution to regional surface and groundwater resources, this project will contribute towards this CALFED objective.

***Project Benefit/Cost Analysis.*** Table 3 summarizes the estimated present value benefits and costs for this project. Over the 20-year analysis horizon quantified project benefits total \$6.8 million in present value. Estimated project costs total \$7.2 million in present value. The benefit/cost ratio for this project, not accounting for direct and indirect unquantified benefits accruing to the region and CALFED, is 0.94.

The benefit/cost analysis produced for this application required the District to estimate the annual costs of operating the landscape budget program through 2020. A breakdown and justification of these annual cost estimates is provided in Table A4. *Please note that this application is not seeking grant funding for these annual program operation costs.* Annual landscape budget program operation costs will be covered by the District and its member agencies through their annual budget processes. The annual cost estimates provided in Table A4 are supportive to the benefit/cost analysis prepared for this application.

***Summary of Grant Funding Request.*** Based on the results of the benefit/cost analysis and an assessment of the contributions this project will make towards meeting stated CALFED Bay-Delta program objectives, the District is seeking \$406,000 in supplemental CALFED funding for this project. This is approximately 60% of the landscape budget development cost shown in Table 2, but only 6% of the estimated present value cost of the program over the 20-year analysis horizon. By funding this project, CALFED will leverage an estimated 5,000 acre-feet of water savings per year. The annualized cost to the CALFED Bay-Delta program to leverage these savings is under \$8/af/yr.

**Table 2. Landscape Water Budget Development Costs: 2001-2002**

	Employee Title	Raw Labor Hourly Rate	Hours	Total Budget	SCVWD Share	CALFED Share
a. Salaries & Wages						
Load area measurement data into budget app.	WC Unit Manager	\$ 46	20	\$ 920	\$ 920	\$ -
	WC Specialist 1	\$ 27	55	\$ 1,485	\$ 1,485	\$ -
Match billing account data to parcel data	WC Unit Manager	\$ 46	120	\$ 5,520	\$ 5,520	\$ -
	WC Specialist 1	\$ 27	550	\$ 14,850	\$ 14,850	\$ -
Develop webITAP web-based Landscape Water Budget system	WC Unit Manager	\$ 46	200	\$ 9,200	\$ 9,200	\$ -
	WC Specialist 1	\$ 27	1,445	\$ 39,015	\$ 39,015	\$ -
	WC Specialist 2	\$ 29	1,100	\$ 31,900	\$ 31,900	\$ -
b. Fringe benefits & Overhead						
FY 1998-99 SCVWD's Federal Office of Management & Budget Circular A-87 Overhead Rate (Will use current rate for Actual Claim) 124.46% x Raw Labor						
Load area measurement data into budget app.	WC Unit Manager	\$ 57	20	\$ 1,145	\$ 1,145	\$ -
	WC Specialist 1	\$ 34	55	\$ 1,848	\$ 1,848	\$ -
Match billing account data to parcel data	WC Unit Manager	\$ 57	120	\$ 6,870	\$ 6,870	\$ -
	WC Specialist 1	\$ 34	550	\$ 18,482	\$ 18,482	\$ -
Develop webITAP web-based Landscape Water Budget system	WC Unit Manager	\$ 57	200	\$ 11,450	\$ 11,450	\$ -
	WC Specialist 1	\$ 34	1,445	\$ 48,558	\$ 48,558	\$ -
	WC Specialist 2	\$ 36	1,100	\$ 39,703	\$ 39,703	\$ -
c. Supplies		[none]				
d. Equipment		[none]				
e. Services or consultants						
Multispectral image acquisition, processing, database	sq. mi.	600	600	360,000	0	\$ 360,000
Resolve parcel boundary and orthorectified image discrepancies.	sites	\$ 2	23,000	46,000	0	\$ 46,000
g Other direct costs						
h. Total estimated cost				\$ 636,947	\$ 230,947	\$ 406,000

**Table 3. Project Benefit/Cost Summary**

Year	Develop landscape budgets	Develop webITAP	Project Mgt.	Provide budget notices	Landscape surveys and workshops	Integration with WMI	Total Cost	Present Value Cost	Annual Water Saved (AF)	Weighted Avg Avoided Cost of Supply	Total Avoided Cost	Present Value Benefit
2001	\$228,560	\$89,913	\$103,000				\$421,473	\$421,473		\$95		
2002	\$228,560	\$89,913	\$103,000				\$421,473	\$397,616		\$99		
2003			\$103,000	\$236,940	\$429,813	\$12,350	\$782,103	\$696,068	5,000	\$102	\$511,004	\$454,792
2004			\$103,000	\$236,940	\$429,813	\$12,350	\$782,103	\$656,668	5,000	\$106	\$529,477	\$444,560
2005			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$472,613	5,000	\$110	\$548,724	\$434,641
2006			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$445,861	5,000	\$114	\$568,766	\$425,015
2007			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$420,624	5,000	\$118	\$589,627	\$415,664
2008			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$396,815	5,000	\$122	\$611,333	\$406,571
2009			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$374,353	5,000	\$127	\$633,906	\$397,721
2010			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$353,164	5,000	\$131	\$657,374	\$389,098
2011			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$333,173	5,000	\$136	\$681,761	\$380,692
2012			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$314,314	5,000	\$141	\$707,096	\$372,489
2013			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$296,523	5,000	\$147	\$733,405	\$364,480
2014			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$279,739	5,000	\$152	\$760,717	\$356,654
2015			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$263,904	5,000	\$158	\$789,060	\$349,002
2016			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$248,966	5,000	\$164	\$818,466	\$341,517
2017			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$234,874	5,000	\$170	\$848,963	\$334,191
2018			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$221,579	5,000	\$176	\$880,584	\$327,018
2019			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$209,037	5,000	\$183	\$913,361	\$319,990
2020			\$103,000	\$51,500	\$429,813	\$12,350	\$596,663	\$197,205	5,000	\$189	\$947,327	\$313,104
Total	\$457,121	\$179,826	\$2,060,000	\$1,297,880	\$7,736,625	\$222,300	\$11,953,752	\$7,234,570	90,000		\$12,730,951	\$6,827,198
<div> <div>Project Benefit/Cost Ratio0.94</div> <div>PV Quantified Regional Benefit Less PV Project Cost(\$407,373)</div> <div>CALFED PSP FUNDING REQUEST\$406,000</div> </div>												

**Major Assumptions used in Table 3:**

1. 6% discount rate
2. FY 2000 constant dollars.
3. 20 year analysis horizon
4. Program reduces water use by sites with dedicated landscape meters by an average of 10%. Detailed calculation is provided in Table A 1 for reference.
5. Weighted average avoided cost of supply is a probability weighted average cost of incremental supply for wet, normal, dry, and critically dry supply years. Detailed calculation is provided in Table A 2 for reference.
6. Program costs based on project budget detail provided in Tables 2 and A3.

Figure 1. Project Schedule and Grant Expenditure Projection for Landscape Budget Development

Project Task/Deliverable	Qtr3 2001			Qtr4 2001			Qtr1 2002			Qtr2 2002			Qtr3 2002			Qtr4 2002			Qtr1 2003		
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Select mapping firm																					
Obtain multi-spectral images and process data																					
Obtain ortho-rectified parcel map of county																					
Resolve parcel boundary discrepancies																					
Load area measurement data into budget app.																					
Match billing account data to parcel data																					
webITAP development; load budget information																					
Load budget data into webITAP																					
<b>Deliverables</b>																					
Multi-spectral image map of Santa Clara County									*												
Landscape classification data table									*												
Parcel map of Santa Clara County												*									
Landscape area measurements													*								
Site-specific landscape budgets																	*				
CALFED Grant Fund Expenditure Projection						\$180,000			\$180,000					\$	46,000						

 = Task Funded by CALFED Grant  
 = Task Funded by District or Local Funding Partners

**Table A1.  
Estimate of Current Landscape Water Use By Dedicated Meter Sites**

Target Use/Acre (ccf)	1,144
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Distribution of Dedicated Meter Sites by Acreage							
Acreage	% of Sites	# of Sites	Avg Acres/Site	Avg Water Use/ Target Water Use	Avg Water Use/Acre/Year	Total Water Use/Year (ccf)	Total Water Use/Year (af)
0.5	17.0%	945	0.25	1.5	1,470	347,035	797
1.0	28.0%	1,556	0.75	1.4	1,405	1,639,661	3,764
1.5	26.0%	1,445	1.25	1.2	1,276	2,305,122	5,292
3.0	14.0%	778	2.25	1.2	1,276	2,234,195	5,129
6.0	6.0%	333	4.50	1.1	1,148	1,721,913	3,953
12.0	4.0%	222	9.00	1.0	1,083	2,167,142	4,975
24.0	2.0%	111	18.00	1.0	1,083	2,167,142	4,975
48.0	1.5%	83	36.00	1.0	1,083	3,250,714	7,463
96.0	0.8%	42	72.00	0.9	1,019	3,057,602	7,019
120.0	0.5%	28	108.00	0.9	1,019	3,057,602	7,019
Totals		5,543				21,948,129	50,386

Target Water Use assumes 1/3 of acreage is landscaping other than turf and requires half the amount of water as turf.

Target Water Use/Acre based on conversations with AquaMetrics LLC.

Avg Water Use/Target Water Use assumes that 25% of landscaped acreage is under-irrigated at a rate of 75% of Target Water Use.

**Table A2.  
SCVWD Avoided Supply Costs  
(\$/AF)**

Year	Incremental Treatment Cost (M&I)	Normal/Wet Years:			Dry/Critical Years:			Total Weighted Avoided Supply Costs
		Variable CVP & San Felipe	Transfer Fee Reservation	Weight	Purchased Water	Variable O&M	Weight	
1998	35.00	47.00	0.00	75	250.00	36.00	0	82
1999	35.00	47.00	0.00	75	255.00	36.00	0	82
2000	35.00	47.00	0.00	75	260.10	36.00	0	82
2001	35.00	47.00	10.00	74	265.30	36.00	1	95
2002	35.00	47.00	10.00	73	270.61	36.00	2	99
2003	35.00	47.00	10.00	72	276.02	36.00	3	102
2004	35.00	47.00	10.00	71	281.54	36.00	4	106
2005	35.00	47.00	10.00	70	287.17	36.00	5	110
2006	35.00	47.00	10.00	69	292.91	36.00	6	114
2007	35.00	47.00	10.00	68	298.77	36.00	7	118
2008	35.00	47.00	10.00	67	304.75	36.00	8	122
2009	35.00	47.00	10.00	66	310.84	36.00	9	127
2010	35.00	47.00	10.00	65	317.06	36.00	10	131
2011	35.00	47.00	10.00	64	323.40	36.00	11	136
2012	35.00	47.00	10.00	63	329.87	36.00	12	141
2013	35.00	47.00	10.00	62	336.47	36.00	13	147
2014	35.00	47.00	10.00	61	343.20	36.00	14	152
2015	35.00	47.00	10.00	60	350.06	36.00	15	158
2016	35.00	47.00	10.00	59	357.06	36.00	16	164
2017	35.00	47.00	10.00	58	364.20	36.00	17	170
2018	35.00	47.00	10.00	57	371.49	36.00	18	176
2019	35.00	47.00	10.00	56	378.92	36.00	19	183
2020	35.00	47.00	10.00	55	386.49	36.00	20	189

Source: Bay Area Water Recycling Program.

**NOTES:** Purchased water refers to District initiatives and programs to secure supplemental supply through banking, dry-year option, long-term contract, and other market-based source acquisition initiatives. The cost of purchased water represented in Table A2 is a proxy value based on current and expected market conditions and opportunities.

**Table A3.**  
**Budget Summary - Program Annual Costs: 2001 through 2020**

Task/Item	Units	Rate (\$/Unit)	Quantity	Annual Cost (\$/Yr)	Years Incurred	Local Share (\$/Yr)	CALFED Request (\$)
<b>a. Salaries and wages</b>							
Project Management and Coordination	hrs	46.0	1000	\$46,000	2001-2020	\$46,000	\$0
Provide budget notices to Landscape Managers and Property Owners	hrs	29.0	3300	\$95,700	2003-2004	\$95,700	\$0
Maintain webITAP and mail serve budget notices	hrs	46.0	500	\$23,000	2005-2020	\$23,000	\$0
Provide ITAP Landscape Surveys to sites with dedicated meters having problems meeting budget	hrs	37.5	4875	\$182,813	2003-2020	\$182,813	\$0
Landscape budget workshops	hrs	29.0	200	\$5,800	2003-2020	\$5,800	\$0
Community Outreach and integration with WMI	hrs	29.0	190	\$5,510	2003-2020	\$5,510	\$0
<b>b. Fringe benefits &amp; Overhead</b>							
Project Management and Coordination	hrs	57.0	1000	\$57,000	2001-2020	\$57,000	\$0
Mail budget notices to Landscape Managers and Property Owners	hrs	36.0	3300	\$118,800	2003-2004	\$118,800	\$0
Maintain webITAP and mail serve budget notices	hrs	57.0	500	\$28,500	2005-2020	\$28,500	\$0
Provide ITAP Landscape Surveys to sites with dedicated meters having problems meeting budget	hrs	48.0	4875	\$234,000	2003-2020	\$234,000	\$0
Landscape budget workshops	hrs	36.0	200	\$7,200	2003-2020	\$7,200	\$0
Community Outreach and integration with WMI	hrs	36.0	190	\$6,840	2003-2020	\$6,840	\$0
<b>c. Supplies</b>							
Postage for budget notices	Notices	0.34	66000	\$22,440	2003-2004	\$22,440	\$0
<b>d. Equipment</b>	[none]						
<b>e. Services or consultants</b>	[none]						
<b>g. Other direct costs</b>	[none]						
<b>h. Total estimated cost</b>				\$833,603		\$833,603	\$0

**NOTES:** The time estimate for annual workshops assumes two two-day workshops and four one-day workshops per year plus time for preparation. The time estimate for information dissemination and integration with the WMI assumes 80 hours per year for report preparation and 50 hours per year for meetings and outreach. Annual project management and coordination assumes a 0.5 FTE staff commitment. ITAP Landscape Survey costs assume 12% of budgeted sites (650) receive surveys each year and surveys, reports, and followups, require an average of 7.5 hours. Annual management of webITAP assumes a 0.25 FTE staff commitment. Annual staff costs for providing budget notices via postal mail assumes 0.05 hours per notice staff time and 66,000 notices per year. This cost is phased out after 2004 when webITAP comes on-line.